

IA. COOPERATIVE AGREEMENT: CA 8024-8-0002

NAME: QUARTERLY MANAGEMENT AND TECHNICAL REPORT

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SHORT TITLE OF WORK: THE ECOLOGY OF THE AQUATIC FOOD BASE  
IN THE COLORADO RIVER.

EFFECTIVE DATE OF COOPERATIVE AGREEMENT: 13 AUGUST 1992

COOPERATIVE AGREEMENT EXPIRATION DATE: 1 OCTOBER 1994

DATE OF THIS REPORT: 30 June 1994

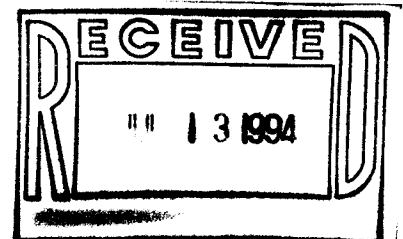
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## II. INTRODUCTION:

Growing concern over the impacts of river regulation on environmental resources in the Colorado River corridor below Glen Canyon Dam prompted the Department of the Interior to develop the Bureau of Reclamation's Glen Canyon Environmental Impact Statement. Following completion of GCES Phase I, the National Academy of Science recommended that further studies integrate interactive phenomena and processes at the ecosystem level in this system (GCES Phase II). The algae and macroinvertebrates provide an important food base for fish and terrestrial fauna and link the aquatic and terrestrial components of the ecosystem. This study of the aquatic food base in the Colorado River was designed to further monitor the effects of discharge on aquatic primary producers and primary consumers in the Colorado River corridor downstream from Glen Canyon Dam through the study objectives.

### II A. MAJOR ACCOMPLISHMENTS DURING THIS QUARTER:

Recolonization and relocation experiments at Lees Ferry and Cathedral Wash were concluded this spring after 11 months of monitoring. Recolonization of Cladophora biomass on treatment cobbles that were air-dried for 6 months and placed back in the continuously submerged zone at Lees Ferry required nearly one year to equal the Cladophora biomass on untreated control cobbles. Treatment cobbles in the zone of fluctuation showed little recolonization of either plants or animals. Oscillatoria, the crustose blue-green alga, was the most common primary producer in the fluctuating zone. Recolonization experiments at Cathedral Wash showed a similar pattern.

In our relocation experiments, cobbles from Lees Ferry were transported to Cathedral Wash (2 RKM below the Paria confluence), while cobbles from Cathedral Wash were relocated to Lees Ferry. These experiments showed that Lees Ferry cobbles covered with Cladophora continued to grow at the turbid Cathedral Wash site (2 RKM below the Paria River confluence), while Oscillatoria covered cobbles relocated to Lees Ferry did not allow Cladophora to colonize to control levels. Macroinvertebrate biomass estimates from treatment samples were near control estimates at both sites. Paria River input of suspended sediments has been below average for this experimental period. Therefore we did not encounter an abrupt change in composition at the Cathedral Wash site that we had anticipated. Further analyses of these data will help understand the ecology of these two important primary producers in the Colorado River ecosystem.

Our June river trip was conducted under clear water conditions. Spring-early summer is the most productive and diverse season for the aquatic foodbase. The combination of low flows (6,000 -12,000 cfs) and warmer water increased overall production downriver. Primary producer biomass and diversity was high throughout the river. At Lees Ferry we collected 100% more Batrachospermum spp., a common red alga. This alga is found in deep water with several specimens collected at a depth of five meters. We also found small amounts in the drift throughout the river corridor

suggesting down-river colonization. Enteromorpha intestinalis, a green alga with a tubular macroscopic plant body, returned again this spring. This alga is adapted to saline/marine habitats which may explain its occurrence in the lower reaches of the Canyon where conductivity increases. Enteromorpha intestinalis is also adapted to the zone of fluctuation and is commonly found in the splash zone on hard substratum above the Oscillatoria zone. No macroinvertebrates were found in association with Enteromorpha. Chironomid densities, both larvae and adults, were very high throughout the study sites. Aquatic insects (water striders, diving beetles and water boatmen) were found along the channel margins in the lower reaches. Although we have not collected any larvae from the mainstem to date we have noted an increase in dragonflies and damselflies (Odonata). Marsh habitats along the river may be one area where reproduction occurs for these insects. These insects are very common in the tributaries which could be another site of reproduction.

Our Spring Canyon (RM 204.0) site has filled in with sediments reducing it to a low velocity area and making collecting difficult. We sampled this eddy and 0.5 mile downstream for comparison and plan to drop the original site during future collections. We added weights to the Petersen dredge (10 lbs) and found sampling easier in the compacted sand of eddies.

Tributaries were sampled for both benthic biomass and drift. Due to the low dry winter/spring discharges we missed the spring peak in biomass as most aquatic insects were in early instar stages. Fire in the Deer Creek drainage may have released nutrients to fuel a bloom of the aquatic flowering plant, Hydrocotyle spp., along the stream margins below the falls. This aquatic macrophyte is generally found only in small patches along quite margins of the river at Deer Creek. Spot insect collections were made below the falls and nothing seemed out of the ordinary for composition or density as a result of the fire. Tributary drift contribution to the mainstem remained low probably due to dry conditions.

Mainstem drift was primarily composed of Cladophora and chironomid larvae. This pattern held for the entire trip; we did not experience the expected increase in detritus downriver. Low volume releases from Glen Canyon Dam, Cladophora patches through to Diamond Creek, and limited tributary input of detritus may explain this change.

Primary production estimates were made in June to complement our winter data set. We have production estimates at Lees Ferry, Cathedral Wash (RM 3.0) and Gorilla Island (RM 220). Due to higher light intensities and greater algal biomass, preliminary analyses showed a 50% increase over winter production at all sites. Later this summer when the Paria River is in spate, we plan to run experiments on the effects of increased turbidity on primary production.

Michael Shaver et al. presented a paper at the Arizona-Nevada Academy of Sciences on 16 April in Mesa, Arizona, and a poster at the annual meeting of the North American Benthological Society in Orlando, Florida. Both presentations were entitled:

Reciprocal transplants in clear and turbid water habitats in the regulated Colorado River, Grand Canyon, Arizona.

We are currently analyzing data and writing in preparation to submit our interim flow monitoring draft final report.

**II B. PROBLEMS ENCOUNTERED:**

No problems were encountered during this quarter.

**II C. FISCAL STATUS:**

1. Cooperative Agreement Amount: \$84,864 (FY92) + \$171,736 (FY93)  
+\$143,232 (FY94) TOTAL: \$399,832
2. Expenditures and Commitments to Date: \$314,302
3. Estimated Funds Required to Complete Work: \$85,530

**II D. ACTION REQUIRED BY NPS:**

No action is requested from the NPS other than continued administrative support of this report.

**II E. FUTURE PLANS:**

Future plans include a June river trip where we will access tributary biomass and composition along with the other monitoring parameters. Loren Haury of Scripps Oceanographic Institute will be our guest researcher and will be examining microplankton in the main stem and tributaries as he did in Phase 1 of the GCES program. Recolonization/relocation collections and primary production estimates will also be completed this spring/summer. We will also analyze data for the final report.

**II F. Equipment Purchases**

Marsh-McBirney Current Meter (\$1,455); NAU paid \$1,645)

**II G. ITEMIZATION OF QUARTERLY EXPENDITURES:**

Salaries:	\$31,054
Supplies:	807
Travel:	551
Equipment:	1,455
<u>NAU Overhead:</u>	<u>7,156</u>
	\$41,023